Chapter 7

Fire and ice: President Portner and technological innovation in the postwar era

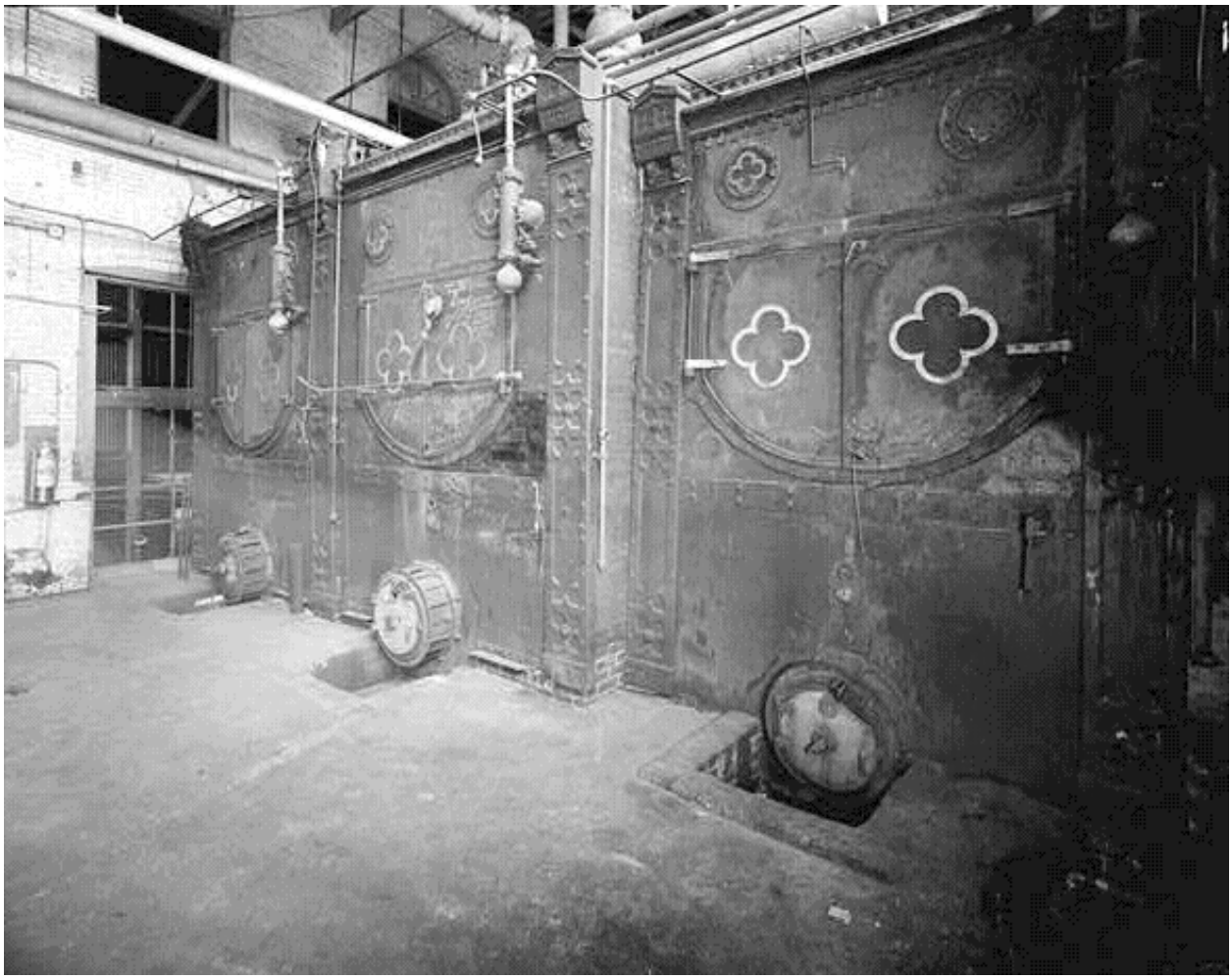
> *The greatest credit for this development [of air-conditioning in breweries] is due to Robert Portner of Alexandria who was among the first to study the effective utilization of such machines and to evaluate them in practice*.
>
> Amerikanische Bierbrauer, May 1885

As for many other industries, the Civil War represented a great divide in the evolution of technology in America's breweries. The war was the impetus for a boom in the rate of innovation. It spurred capital accumulation and improvements in transportation, agriculture, metallurgy, machine tools, and chemistry.

The full range of variations in and improvements of the brewing process in the nineteenth century are too numerous, and often too technical, to fully explore. However, there were several salient inventions and innovations that revolutionized the American brewing industry. It was during the eighteenth century that brewing began to evolve from a mysterious art toward a more scientific enterprise. The thermometer and saccharometer were first put to use to monitor the temperature and specific gravity of the wort through each stage of its processing. The steam engine, useful for a variety of tasks, was introduced to a few of the large British and New England breweries before the turn of the nineteenth century. But major advances in refrigeration, bottle manufacturing, and the preservation of perishables occurred after the Civil War. These encouraged a dramatic growth in the brewing industry. (Baron 1962:157-158)

Among the nineteenth-century "high points" of innovation enumerated by brewing experts Siebel and Schwarz were the isolation of pure yeast; the full application of steam power; mashing by machine; steam boiling; mechanical refrigeration; and bottling on a large scale. The general result was a process and a product more controllable, reliable and consistent—and labor costs were much reduced. (Siebel and Schwarz 1933:86)

Applications of steam power ultimately included the operation of grain elevators, hoists, pumps, conveyors, malt mills, mash stirrers, washers, bottling machinery, ice-making and refrigeration machines, and coopers' tools. Steam engines could control the movement of the wort between each stage of production. Steam boilers were far more efficient and controllable than wood fires for boiling mash water or wort in the brewing copper. Alexandria's Irwin's ale brewery possessed a steam engine before the plant was destroyed by fire in 1854, and two later brewers, Henry S. Martin and Robert Portner, each had steam engines by 1866. About 1869 Portner upgraded from an eight-horsepower engine to twelve-horsepower. It likely powered at least the brewhouse grain elevator, pumps, and mash agitators by means of a system of overhead belts, gears and pulleys. This engine was less powerful than the average 14.4 total horsepower then in use in American breweries. On the other hand, most firms still had no steam power. Virginia then had at least six breweries, with



Steam boilers in the vacant John Wiessner/American Brewery of Baltimore, early 1970s. Historic American Engineering Record photograph, Library of Congress.

only three engines between them, and those belonging to the other breweries were probably each smaller than Portner's. As production grew, Portner's early engines were replaced by a succession of larger ones;[1] by the turn of the twentieth century, the plant's boilers were capable of producing up to 1,200 horsepower. (United States Census 1860b; Alexandria Circuit Court Deed Books X-3:513; United States Census 1870b; Wallace 1870:396; Wedderburn 1907)

Perhaps the most important use of steam was to power the railroad locomotive. The explosive increase in track-miles after the war revolutionized the ability for manufacturers to reach customers and thus penetrate regional and even national markets. St. Louis' Anheuser-Busch brewery was a pioneer in setting up a large system of trackside ice plants to replenish the ice in the brewery's refrigerated rail cars; its Budweiser lager was available in the mid-Atlantic by the mid 1880s. As we have seen, Robert Portner would expand his market into Washington in 1875 and into many

[1] Portner sold a used twelve-horsepower engine in 1873, for instance, when he upgraded to a more powerful one. (*Evening Star* May 22, 1873)

cities thereafter (see Chapter 8). In early 1880 he "placed upon the Virginia Midland Railroad two handsomely painted refrigerator cars, to be used exclusively in the transportation of beer." The brewer soon accepted a position on the railroad's board of directors. By 1896, his own cars traveled at least 693 miles over the rails, presumably confined to the state of Virginia. (Krebs and Orthwein 1953:277; *The News* June 12, 1885; Interstate Commerce Commission 1897:271)

Steam brewing and the use of the steam engine became universal in the industry, but only by the end of the nineteenth century when breweries were bigger and the technology more affordable. By then, electricity began replacing it for many uses. Electric power came into use first for lighting, then for running mash agitators, beer pumps, conveyors and elevators, refrigeration compressors, bottling and bottle washing machines, pasteurizing tanks, and labeling machines. After the turn of the century, some breweries even tried using electric trucks for local delivery and for moving barrels and equipment around the grounds. Washington's first electric truck appeared at the National Capital Brewing Company—an enterprise partly owned by Robert Portner—in 1903, capable of hauling five tons of barrels, the work of at least six draft horses.[2] Between January and March 1886 the Consolidated Light Company (the predecessor of Consolidated Edison) of New York installed an electric dynamo in the Portner plant. It ultimately powered 100 incandescent lights placed throughout the building, the first use of electric light in Alexandria. By 1897 all of the plant's lighting was electric. Portner's dynamos were soon employed in brewing tasks as well. Many brewers preferred the new power source as cleaner and more efficient than steam. By 1907 the Alexandria plant equipment could generate a total of 100 kilowatts of electricity, and the brewery had at least one trained electrician on staff. A section of wooden conduit filled with insulated wires was uncovered during archaeological investigations of the former brewery site in 1998.[3] Electricity was also introduced to the depots. The Augusta, Georgia branch, for instance, was lighted with electric by 1904 and had a 125-horsepower generator. The company installed an electric bottle washing machine at its Frederick, Maryland branch in 1906, suggesting that the other bottling operations were similarly equipped. Robert's sons took an interest in electric gadgets; son Alvin would even become a member of the board of the Alexandria Electric Company a few years later. (Wallace 1870:396; Baron 1962:160,161; *Western Brewer* December 1904; Miller 1996; Wedderburn 1907; *Washington Post* March 17, 1895, October 8, 1897, March 29, 1903 and February 10, 1910; *The News* September 24, 1906; Sanborn Map Company)

Electricity sparked a communications revolution. Portner's 1876 Washington depot was connected to the brewery, at least indirectly, by telegraph. In September 1880, Western Union installed a telegraph in the Portner offices, to be operated by a permanent telegrapher, E.B. Padgett, and connecting "to all the world." But before Christmas, the local Western Union/Bell Telephone representative, W.T. Gentry, was accepting subscribers for phone service. With the telegraph line in place, Gentry was able to hook up and successfully test telephone receivers in his office and that

[2] With its wealth, the Portner family itself owned automobiles quite early. Robert even had a racing car in 1902, although it was actually driven by his African-American chauffeur, Edward Dickerson. Daughter Hilda purchased an electric "Victoria" in 1913. The Portner brewery may have used a gas-powered truck by 1912, but seems to have relied on "hayburners" for local shipping until the company closed, with three to six delivery wagons in Alexandria during the 1912-1916 period, plus at least one buggy and one trap. (*Washington Post* January 18, 1903 and August 10, 1913; Summers Company)

[3] A thief stole 400 pounds of copper wire from the brewery in 1913. (*Washington Post* November 19, 1913)

of the brewery in mid February. The test encouraged subscribers, but only large businesses, institutions and affluent individuals could afford the $40-per-year service at first.[4] With a Southern Bell exchange established in Alexandria, the brewery was among the first 46 hooked up. The phone came in handy a few months later to summon medical assistance when one of the plant's engineers was badly scalded. Alexandria's exchange was connected to Washington's in 1882, and by 1892 the Robert Portner Brewing Company was able to take orders and keep tabs on its far-flung distribution system almost instantaneously.[5] (*Alexandria Gazette* August 12, 1880, September 13, 1880, December 20, 1880, January 8, 1881, February 14, 1881, December 10, 1881, March 4, 1882, July 24, 1882 and July 25, 1896; *Washington Post* February 12, 1881; Emerson 1881; Turner 1892)

Until the late 1870s natural ice, cool cellars and springhouses were the only sources of refrigeration. Brewers could generally produce beer only during the colder months. Alexandria brewers made their first attempts at summer brewing during the Civil War, when demand was high enough to make quality considerations inconsequential and the expense bearable. In August 1868 Alexandria ale brewer Henry Martin advertised the availability of a new batch of his product, qualifying it as some of the finest ale "ever manufactured at this season of the year..." Robert Portner's brewery, however, operated only eight months a year into the 1870s. Ice was locally available only cut from the Potomac or the Alexandria Canal during winter and available in quantity for industrial purposes shipped in schooners from Maine, meaning considerable costs for transport, storage and wastage. The Portner brewery maintained an ice storehouse near the tide lock basin of the Alexandria Canal and cut ice from the canal, until that structure burned in 1878. (*Alexandria Gazette* August 18, 1868 and April 30, 1878; United States Census 1870b; *Washington Post* December 27, 1878)

The cost and labor involved with the use of ice cannot be overestimated. After a warm winter, such as that of 1879-1880, natural ice in the Washington metropolitan area could reach $8 a ton or 60 cents per 100 pounds. Ice was packed in lager cellars, freight cars, and attemperators, and it provided ice water for wort coolers. Its provision and maintenance were probably the most difficult aspects of the brewing process. Ice in cellars required constant packing and repacking—backbreaking work in very damp conditions. Period documents suggest that the packing of the cellars with ice could take a group of men several days. Within the cellars brewers had to deal with excess water, mold and other residue, and stale or unpleasant odors which could only be ameliorated by cleaning, good drainage and ventilation. Under these conditions, cellarmen often complained of respiratory illnesses. (*Alexandria Gazette* March 26, 1880; Beamon and Roaf 1990:126-127; Kelley 1965)

Brewers first used artificial refrigeration to cool the water that ran through the wort cooler ("Baudelot") pipes, then it was gradually adopted for cooling entire rooms, arresting ice melt, dehumidifying, and actually manufacturing ice. Once they had gained sufficient confidence in new refrigeration devices they were able to cut labor costs and to make more advantageous use of

[4] The town's first use of a telephone was an early 1878 test between two receivers hooked up to the ends of telegraph lines in Alexandria and Charlottesville. The first permanent phone sets connected the depot of the Virginia Midland Railroad with its Alexandria office in 1879. A few months later, city leaders began discussing an exchange that would connect to Washington. (*Alexandria Gazette* January 21, 1878, June 26, 1879 and November 10, 1879)

[5] The Danville branch had a phone by 1892, suggesting that by that date the brewery's entire distribution system was likely connected. (Turner 1892)

ICE. ICE. ICE.

I have received and shall continue to keep on hand a full supply of the

BEST KENNEBEC ICE,

which I am desirous to dispose of in large or small quantities at the

LOWEST POSSIBLE PRICE

Persons in the city can arrange with the drivers, or leave their orders at Brengle's, Appich's or Schafer's confectionery store.

Orders from the country will receive promp attention.

my 26–tf JOHN S. BEACH.

Above: A Great Falls Ice Company wagon at Congress Heights, D.C., circa *1905. John D. Bartlett, company superintendent, was one of the original board members of the National Capital Brewing Company. Historical Society of Washington, D.C. photo. Right: An* Alexandria Gazette *advertisement for Kennebec River, Maine ice, still commonly used in Alexandria in the 1880s, even by the brewery.*

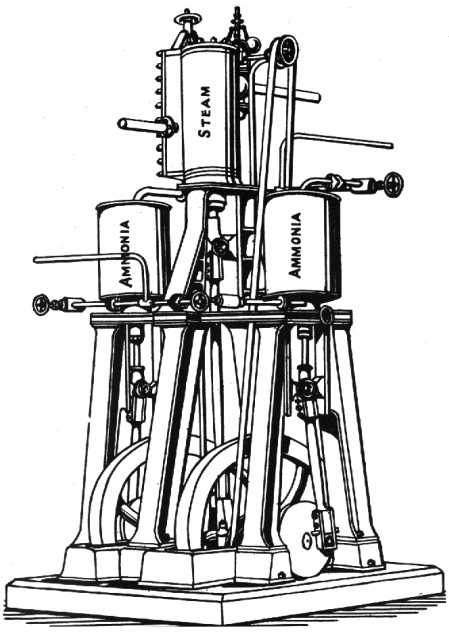
their cellar space. They could also create a better product since temperatures could be controlled more exactly. In fact, artificial refrigeration made possible reliable year-round production and consequently much higher production. Refrigeration and air-conditioning also changed brewery architecture. Lager fermentation and storage moved above ground into convenient, insulated structures, making natural or man-made cellars obsolete. Wort cooling relied less on convection and exposure to the open air and thus could be conducted in closed containers in lower levels of breweries, reducing reliance on pumps and exposure to wild airborne microbes. Cooling compressors and condensers required their own space, often occupying "whole rooms." (Kelley 1965:200,317; *Alexandria Gazette* February 1, 1878; Thevenot 1979:76; Anderson 1953:91; Schlüter 1910: 55-56,64; Appel 1998:249).

Refrigeration and air-conditioning were largely responsible for making Robert Portner's national reputation. Ever an innovator, he closely followed the early research in this area and implemented his own adaptations in order to put the technology to practical use in his plant.

> All my thoughts were turned to introducing one of these days an ice or air-cooling machine. Whenever I could see anything of this kind I went to investigate. I heard about a man named [Thomas] Cook in Philadelphia who experimented on such a machine. I went to see him [at the Centennial Exposition of 1876] and we became acquainted. I learned about its construction and the principles on which it worked, and I bought a machine built by him. My improvements were completed in the spring of 1878 and [it] was the first machine of its kind which worked well and was of practical value.... (Portner n.d.:16b)

The modified Cook machine was patented in 1880. Portner and his former clerk, Edward Eils, now a 39-year-old patent attorney, were the patentees. Basically, the design called for the cooling of fermentation rooms and storerooms from above by running compressed ammonia, liquefied and in solution with water, through pipes along the ceiling or walls. The rapid phase change of the chemical into an expanding gas drew heat and moisture from the surrounding air just as modern air-conditioning does. (United States Patent Office 1880; Boyd 1885)

Portner's machine was not the first of its kind. Artificial ice-making machines were invented in the 1850s and 1860s and introduced into American breweries by the 1870s. An Australian brewery installed an air-cooling system using ether as a refrigerant in 1860. A similar, but improved version of the same apparatus was purchased by a London brewery in 1868. Portner's air-conditioning machine was ultimately derived from French experiments, particularly by Ferdinand Carré, with anhydrous ammonia as the refrigerant. Machines using ammonia were placed in breweries in New Orleans in 1869, Brooklyn in 1870, and Alexandria, Egypt before 1876. Ferdinand Heim of Kansas City had a David Boyle-made machine by 1878—"one of the first really successful ice machines to be installed in any brewery in the United States"—leading Frederick Pabst to try Boyle machines from 1879 on. But the earliest ammonia machines were too small to be truly effective, and ether, an early alternative, proved too volatile and expensive. For these reasons, Portner received credit from the trade magazines *Ice and Refrigeration* and *Amerikanische Bierbrauer* for creating one of the first practical and successful systems.[6] As late as 1950, the Journal of the



David Boyle's compressor, from One Hundred Years of Brewing.

[6] Sometimes he is erroneously given credit for the *invention* of artificial air-conditioning or for its first use in a factory. In addition to the *circa* 1870 installations cited above, it should be pointed out that the firm of David Boyle & Company installed its first refrigerating machine in a Chicago brewery in 1877, and then ones in East Saint Louis, Louisville, and Milwaukee in 1878—the latter year being the same during which, apparently, Portner's was first up

Patent Office Society called his improvements "one of the basic developments in the air-conditioning art." Of course, even such "practical" systems could be troublesome. In September 1881, one of the Philadelphia-made pumps attached to the air-conditioning compressor broke, "doing considerable damage to the machinery and scattering the hands at work in the building at the time. The room was immediately filled with ammonia to such an extent that it was impossible for any one to enter it. Large castings were broken and about $100 worth of ammonia was lost." (H.S. Rich & Co. 1903:122,125,293; Schlüter 1910:56; Gillet 1876:13; Krebs and Orthwein 1953:277; Cochran 1948:108; *Alexandria Gazette* September 6, 1881)

Portner also tinkered with beer coolers, initially coming up with only "impractical" and insufficient solutions, at least one of which he nonetheless patented with the assistance of Edward Eils. He installed ice-making machinery in the plant at an early date to fill the insulated freight cars in which the brewery shipped its product. He was creating his own "ice factory" in February 1878 in order to "make a ton of ice cheaper than it can be bought of any of the ice companies." His first ice machine, capable of producing "several tons a day," arrived from Philadelphia that April. Years later, he would sell his surplus ice for home and business use. His excess capacity presumably presented a barrier to entry of other suppliers in Alexandria's consumer ice market. His operation was enough, apparently, to scare off an ice factory proposed by New York investors. According to Alexandria directories, during the first half of the 1880s there were three other ice dealers, all selling natural, Northern ice—and then only two such firms until the turn of the century. These then joined forces in a new Mutual Ice Company, which manufacturing its own product and bought surplus Portner ice to satisfy the local demand. (United States Patent Office 1878; *Washington Post* February 19, 1878 and July 6, 1952; *Alexandria Gazette* February 1, 1878 and April 22, 1878; James Boyd Williams, Jr. Papers)

According to Portner himself, his air-cooling device

> had taken an enormous amount of trouble and work and the constant meditating and brooding over this problem was probably the main reason for my later illness, the excessive irritation of the nerves.
>
> After the machine was being used I went to Germany to regain my health. There I visited many breweries and everybody else who was connected with ice machines, but I did not find anything of practical value. After my return I started all over again, and in the fall I constructed the first beer-cooling apparatus with ammonia which one year later [John C.] De La Vergne got a patent for. I kept working on the idea and took out other patents. (Portner n.d.:16b)

Many of his peers were interested in Portner's refrigeration innovations. After the United States Brewers Association conventions in Washington and Baltimore in 1878 and 1882, dozens of his colleagues toured his plant "to look at my miracle machine. Although only small, it served its purpose well, and I believe that through it I became the main reason for the further development

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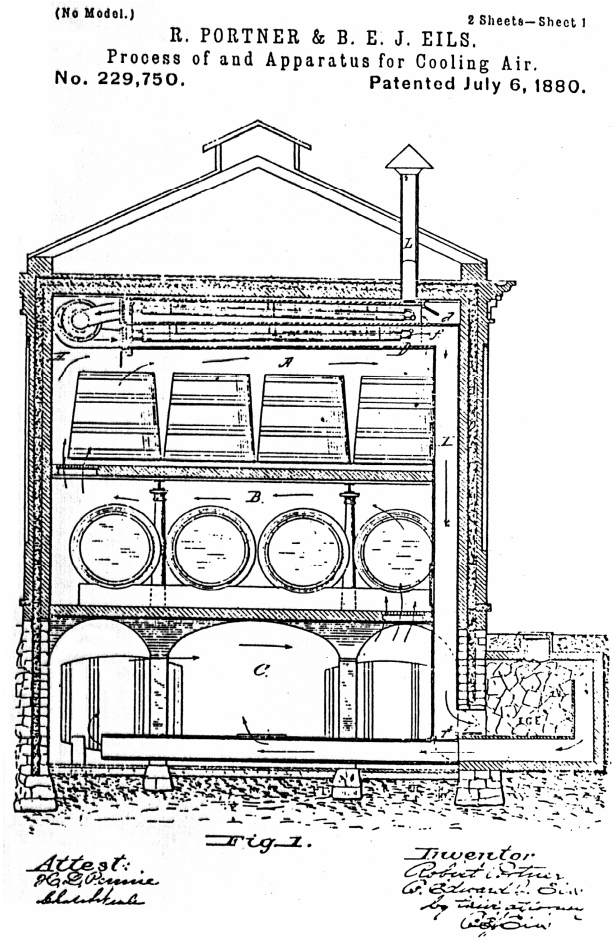
and running. Stanley Baron, however, credits Portner's machine as being the first complete success. (Gordon 1950; Fort 1958:15; Skinkle 1897:7-8; Baron 1962:235; Tyler 1909:353)


(No Model.) 2 Sheets—Sheet 1

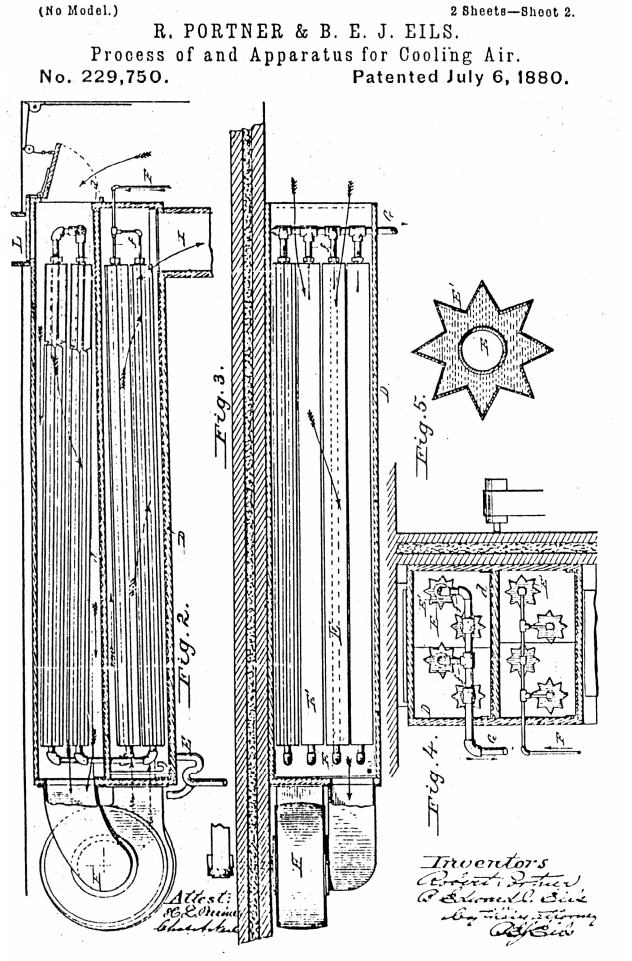
R. PORTNER & B. E. J. EILS.

Process of and Apparatus for Cooling Air.

No. 229,750. Patented July 6, 1880.

Fig. 1.

Attest: Inventor: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R. PORTNER & B. E. J. EILS.

Process of and Apparatus for Cooling Air.

No. 229,750. Patented July 6, 1880.

Fig. 3. Fig. 5. Fig. 2. Fig. 4.

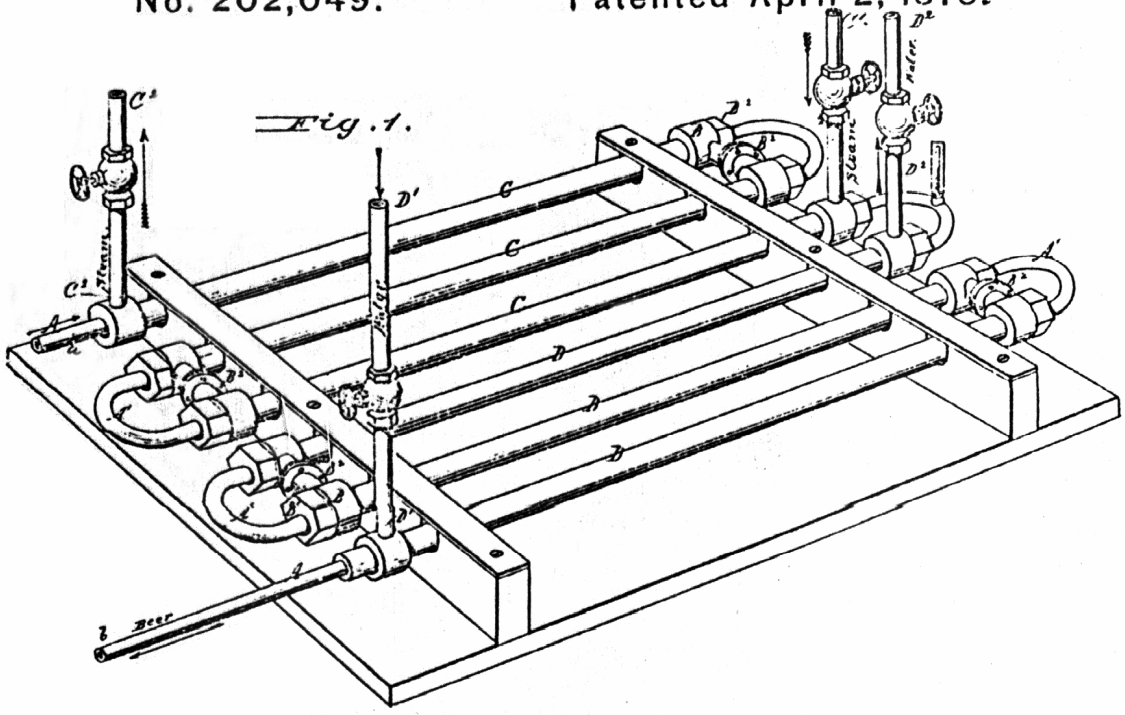
Attest: Inventors:

Above left: Patent drawing for Portner's air-conditioning system. Above right: Circa *1970s model of his patent at the U.S. Patent and Trademark Office.*
Right: Detailed patent drawing of Portner's improvements upon the Cook refrigeration machine.

R. PORTNER.
Beer Cooler.

No. 202,049. Patented April 2, 1878.

Fig. 1.



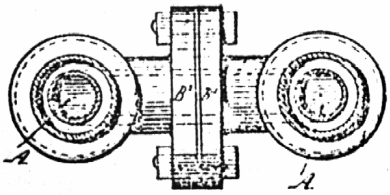
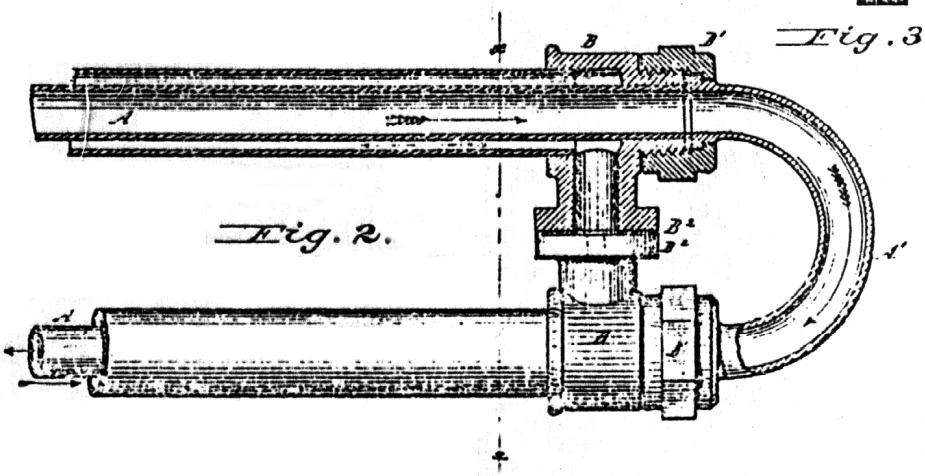


Fig. 3.

Fig. 2.



Attest:
H. C. Dewey
Chas. F. Wells

Robt. Portner,
Inventor.
By.
Atty.

of such machines." The brewers "declared unanimously that although the capacity was not as great as several others, Portner's was decidedly the most complete and best arranged brewery in the United States." One of these visitors, Emil Schandein of the Philip Best Brewing Company of Milwaukee, wrote a favorable account to his brother-in-law, Frederick Pabst: "So far the Cook system seems to be the best for it serves its purpose and keeps the cellars as dry as a room. With Portner's improvements it can't be surpassed." There was also interest from those outside the industry. In May 1879 a United States House of Representatives "Committee on Ventilation" visited the brewery to assess the "proposition… to place one in the basement of the House to cool the atmosphere." But the Capitol would not be air-conditioned until the late 1920s. (Portner n.d.:16b; *Alexandria Gazette* June 8, 1878 and May 13, 1882; H.S. Rich & Co. 1903:556; Baron 1962:235; *Washington Post* May 1, 1879)

In demonstrating his invention, Portner was not interested in bragging rights or the dissemination of practical scientific knowledge. Shortly after he completed his first machine—indeed, nearly two years before it was patented—he founded the Brewers' Refrigerating Machine Company, with an initial capitalization of $5,000, to take orders from other firms for copies of the apparatus. He had the machines built in New York because there was both a substantial market there and the necessary resources for fabrication. The Alexandria brewery then became a sort of showroom. The company incorporated in the District of Columbia in 1881 with Edward Eils, former clerk and co-patentee, as secretary and George F. Ott, a Philadelphia coppersmith and probable fabricator and supplier of parts, as the third officer. Edward Norris was one of the company's agents and technicians responsible for installation. The new firm sold and installed at least two machines in the second half of 1878. But it was another unit, sold at the beginning of 1879, that became a real problem for Portner. (*Alexandria Gazette* November 5, 1878; H.S. Rich & Co. 1903:124-134; *The Manufacturer and Builder* July 1884; *Alexandria Gazette* September 26, 1878 and October 5, 1878; *Washington Post* June 7, 1880; U.S. Supreme Court Center)

On January 11, 1879, Michael Seitz, owner of the Nicholas Seitz's Son Brewery of Brooklyn,[7] signed a contract to take delivery of a "No. 2" refrigerating machine with a down payment of half the $9,450 purchase price. It seems that Portner or his agents had assured Seitz that the engine would successfully and continuously cool to 40 degrees Seitz's 150,000 cubic feet of fermenting cellars, obviating further use of ice. Suddenly, with feet colder than he expected his brewery to be, Seitz requested of Edward Eils a written guarantee to that effect. The response was qualified but reassuring:

> [T]here are a great many other things entirely beyond the control of the machine which influence this temperature. The mode of working the rooms, the water used for washing, the fermentation, and many other things might be mentioned in this connection… We are confident, from the experience with the Portner machine during last summer and fall, that the machine sold to Mr. Seitz will not only give him the desired low temperature, but will, in addition, give him what he never before had in the warmer months, namely, pure and dry air. The machine we are building for him is in many respects far superior (aside from size) to the Portner

[7] Nicholas Seitz, Michael's father, founded the Maujer Street brewery in 1846 but had died about 1871. (Van Wieren 1995:224)

> machine, and when he has had it a year we believe he would not part with it for any money, if he could not replace it.

Seitz went ahead with the installation, but found unsatisfactory both the machine's performance and the lack of a guarantee. Resolving not to pay, he forced Portner to sue, a case ultimately settled by the Supreme Court of the United States. The high court ruled in favor of the Brewers' Refrigerating Machine Company because the contract had been executed without an express warranty and because Seitz had nonetheless taken delivery.[8] The Seitz case likely harmed business for the refrigerating company, but another Brooklyn brewery nonetheless purchased a Portner "ice machine" in 1880. (Van Wieren 1995:224; *Seitz v. Brewers' Refrigerating Machine Company*;[9] *Washington Post* June 7, 1880)

The Seitz case was not Portner's only difficulty in the refrigeration business. The situation nearly repeated itself when he sold an ice machine to the Enterprise Brewery of Elias Adler and Paul Muhlhauser in Baltimore in 1882. It was apparently Portner's original and now used, which accounts for a reduced price of $1,200, to be paid for in full within four months. When eight months had passed, the partners had still not produced the money. When Portner threatened to sue, Adler sought an extension backed by his promissory notes. The issue was still not settled when it went to court in 1885-1886. Adler, like Seitz, then claimed that the machinery failed to work as well as promised, and his delay in payment had been simply to have sufficient "time to test the machine." Muhlhauser, who had been Portner's brewmaster (see pages 57 and 141) and was familiar with the working of the machine in the Alexandria brewery, tacitly acknowledged his firm's culpability by not answering the complaint and accepting a default judgment. By the time the matter reached the appeals court, he had had rejoined Portner's firm. Adler lost the original suit and an appeal. (*Elias E. Adler v. The Robert Portner Brewing Company*;[10] Van Wieren 1995:130)

Portner and Eils transferred their patents to the Brewers' Refrigerating Machine Company at the time of its incorporation, but manufacturing ceased about the same time. The company's new headquarters—Edward Eils' law office at 703 7th Street, NW, kitty-corner across from the U.S. Patent Office—was increasingly focused on legal actions, including the twelve-year-long battle with Seitz and defenses of patent rights. The men dissolved the company in the mid 1880s, partly as a consequence of the settlement of various suits. (Boyd's Directory Company 1882; Boyd's Directory Company 1883; Lain & Co. 1889; H.S. Rich & Co. 1903:556)

Like most inventions and innovations, Portner's cooling system was the product of the clever practical application of an accumulation of technical knowledge and experiment, distinct enough to justify a patent but not a wholly novel and fully formed creation sprung from the imagination of a single man. Indeed, as his own account suggests, many other brewers, inventors, engineers and practical scientists were working along the same lines—not only Boyle and De La Vergne, but also Theodore Krausch, Edmund Jungenfeld, Fred W. Wolf and others. Portner's patents were only two among an avalanche of inventions and improvements beginning in the mid 1850s and were preceded by dozens of U.S. air-conditioning patents and were contemporaneous with several ice

[8] The case has since been frequently cited as a precedent in contract law.
[9] 141 U.S. 510; 12 S. Ct. 46; 352 Ed. 837; 1891 U.S. Lexis 2540.
[10] 65 Md. 27; 2 A. 918; 1886 Md. Lexis 4.

machines.[11] In fact, many were so similar that claims of copying and patent infringement harmed Portner directly. "There were numerous lawsuits, and finally [Portner] sold his claims for around $50,000. The outcome was always one of the big disappointments of his life." His memoirs intimate that his greatest dispute may have been with John C. De La Vergne, a tinkerer who was briefly co-owner of the Hermann Lager Beer Brewery of Manhattan and who, with William M. Mixer, patented an ice-making machine in early 1881. Oddly, Portner claims that his own beer cooler was patented by De La Vergne, but does not clarify whether this was with his knowledge or permission. Portner clearly received a patent for one type of beer cooler. Although most patents built upon earlier ideas, the "cutting edge" was always a shifting frontier. Of his own experience with technological advance, Washington brewer Christian Heurich would later write, "what came in was going out just as fast, for as time passed I modernized and improved and purchased equipment at every opportunity." Portner's innovations, like most others, eventually became obsolete, although he used his first air-conditioning compressor until it was "literally worn out"—which may

A circa *1901 Library of Congress photograph of the east side of the 700 block of 7th Street, NW, Washington, D.C. At the center of the image, behind the utility pole and huge awning, is 703 7th Street, the "Tennille Building," the former office of patent attorney and Portner colleague Edward Eils. In his capacity as secretary of the Brewers' Refrigerating Machine Company, he ran the short-lived corporation from this headquarters during the early 1880s. Robert Portner bought the building in 1885 for $16,000.*

[11] Portner claims to have secured additional patents, but he is only credited for the two in the United States Brewers' Association's *List of Patents Relating to Malting, Brewing, Refrigerating, Bottling and Kindred Subjects*, published in 1905. The Patent and Trademark Office database also does not credit him with more except for shared for a fire-resistant paper (see page 20).

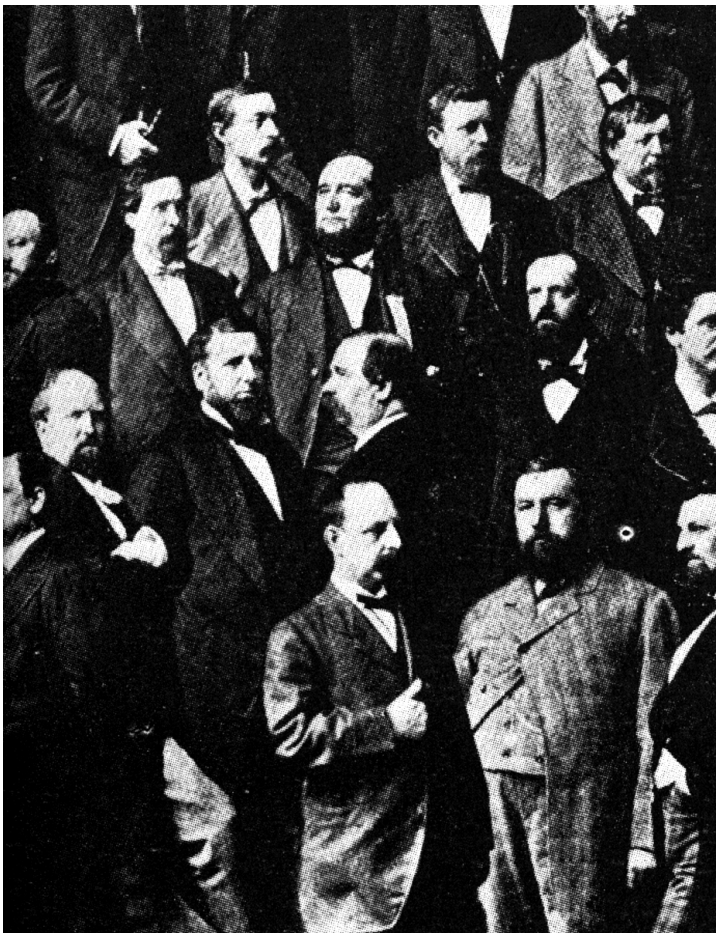
have been by 1884, when he purchased a "Ballantine" refrigeration machine from the Cummer Engine Company of Cleveland (although he purchased two four-ton compressors from New York for his ice house in 1882). By 1891, when the Seitz case was finally settled, the brewery was on perhaps its third generation of refrigeration machines, including a 30-ton ice plant and three air-conditioning machines producing cold air equivalent to 150 tons of ice, all equipment presumably manufactured by and purchased from others. (American Society of Heating, Refrigerating and Air Conditioning Engineers 2004; Portner n.d.:16b; H.S. Rich & Co. 1903:124-134 and 556; Van Wieren 1995:245; United States Brewers Association 1905:21-23; Nagengast 2004; Heurich n.d.:43; *Washington Post* March 30, 1891 and August 14, 1937; *Alexandria Gazette* March 24, 1882; *The Manufacturer and Builder* July 1884 and January 1885)

Even if his refrigeration patents added modestly to Robert Portner's wealth, they greatly augmented his prestige in the brewing community. A member of the United States Brewers Association (U.S.B.A.), the brewers' lobby, since before 1871, he was quickly elevated to leadership at the end of the 1870s. He had prepared the way by serving in a number of leadership positions, including as an envoy to Congress and to the Commissioner of Internal Revenue, demanding reductions in excise taxes and duties on foreign and domestic malt and hops;[12] as a member of the Committee on Resolutions, the Finance Committee, the Legislation Committee, the Agitation Committee, and the Washington Committee; and as a vice-president. At the 1877 convention he signed the "Certificate of Incorporation," the organization's new constitution, and was named one of several honorary presidents. The following year there was a movement to elect him to the top post. Finally, in June 1880, "Mr. Portner's prominence as a brewer was recognized by his election to the presidency..." (United States Brewers Association 1896:276,290,329,353,386,423-425,428,430,458,468,469; H.S. Rich & Co. 1903:556; Alexandria Gazette June 8, 1878; *Washington Post* April 5, 1879; *New York Times* June 5, 1874)

> Hardly any of the other brewers could claim so many good friends among their members as I had. All my thoughts had always been directed toward the general welfare and the development of the Association. When controversies developed, I was always the one who could mediate them quickly. Already in 1878, the Association wanted to elect me, but I was not nominated at my request because I was just about to leave for Germany. When I was on my way to the [1879] convention in Boston, I heard in New York that I was to be elected president. I remained in New York because I was afraid to accept such a responsible position besides all my other activities and because I wanted to avoid being obtrusive. But a few days later I was notified by telegram... that in spite of everything I had unanimously been elected president. In this way my work increased again—I often had to attend to business for the Association in Washington and to go to New York to preside over the committee sessions... (Portner n.d.:17)

He was elected by his peers despite the fact that his firm was much smaller than many of the Northern breweries and was located in an industrial backwater. Rare indeed was a U.S.B.A. officer

[12] The government assessed additional taxes on "the quantity of malt consumed over and above two and one-half bushels per barrel..." In other words, taxation not only cost brewers dearly but could affect the quality of their product by influencing the amount and type of ingredients. (United States Brewers' Association 1896:423)



Left: Some attendees of the 1877 convention of the United States Brewers Association. Robert Portner is at the top left. This image, republished in One Hundred Years of Brewing*, is not an actual photograph, but a composite picture derived from many individual photos.*
Right: Robert Portner, 1885, from that year's souvenir booklet of the United States Brewers Association convention.

from the South; the 1880 board consisted of Portner, one Pennsylvania brewer, and three New York City brewers. Portner's election can be credited to his demonstrated leadership, his innovation, and his proximity to Capitol Hill. While Prohibition was still many years off, one of the main issues of the 1880 convention was Congressional consideration of the creation a committee to investigate the "alcoholic liquor traffic." The U.S.B.A. naturally opposed it, but supported any "honest efforts to check the evils of intemperance." The Association also narrowly supported a tariff on imported malt and discussed plans to establish a brewers' academy. Unfortunately, because of his chronic ill health during this period, Portner did not serve out his term. He resigned and, on the advice of his doctor, took an extended vacation in Germany. He remained modestly active in the U.S.B.A. until at least 1898, when he lobbied Congress against a beer excise increase to finance the Spanish-American War. (H.S. Rich & Co. 1903:554,556; Portner n.d.:17; *New York Times* June 4, 1880 and April 7, 1898; *Alexandria Gazette* April 7, 1898)

By the late 1870s Robert Portner's successful brewery was performing a considerable amount of bottling, the containers being popular in bars and beginning to find their way into households. Beer had been imported from Great Britain in bottles since the eighteenth century, but the containers were fragile, expensive, and not entirely airtight. Shortly after America's Civil War, the price and durability of glass bottles became competitive with those of stoneware containers. A lighter material, glass was a cheaper alternative for transportation. Its transparency was a boon to sales of beer and simplified the cleaning and reuse of the containers. Improvements in molding and the invention of automatic bottle-making machines after the turn of the twentieth century quickly made bottled beer a ubiquitous product.

Even in sealed bottles, beer, especially lager beer, always ran the risk of spoiling by becoming flat, stale or bad tasting. Louis Pasteur's work on microbiology taught brewers the reasons for spoilage and suggested remedies. The importance of eliminating "wild" yeasts and other microbes from beer became clear. Most brewers converted to the use of closed brewing vessels and fermenting tuns. From Pasteur they also learned that the application of heat could kill "germs." Brewers and inventors developed various devices to "pasteurize" the beer, rapidly heating to about 145 degrees and then cooling bottled beer to destroy any microbes remaining within. Anheuser-Busch's early adoption of pasteurization (1873) gave the company an immediate advantage in the shipping and sale of its beer over a broad area. Robert Portner also tinkered with pasteurizers but unsuccessfully. He undoubtedly purchased pasteurizers during the second half of the 1870s, however, and, like other brewers, employed new, efficient cold filtration systems for racking off pure beer into bottles and kegs. In 1894 the Robert Portner Brewing Company adopted the Pfaudler vacuum fermentation system, employing closed, glass-lined steel tanks that could capture and retain carbonic acid from the fermenting beer, to be reintroduced for more effervescence. (Kelley 1965:445; Lief 1965:1; Portner n.d.:16b; Anderson 1908:187; H.S. Rich & Co. 1903:402)

Even with pasteurization, bottled beer could not be preserved with confidence without the development of reliably airtight closures. Hundreds of ideas for new closures were patented after the Civil War in order to replace the inadequate cork. Before the turn of the century the most popular types were the Hutchinson, Lightning, and Baltimore loop closures, invented in the 1870s, and similar porcelain stoppers. These gasketed stoppers effectively sealed glass bottles against and the admission of foreign microbes. In 1892 an even more reliable closure, the crown closure or modern "bottle cap," was patented. It eventually replaced other types. Documents and extant examples of Robert Portner Brewing Company bottles suggest that the brewery had adopted Lightning, Hutchinson, and Baltimore loop closures by the early 1880s and porcelain stoppers by the mid 1890s. The company's Tivoli Hofbrau brand was capped with crown closures by 1895, but bottle caps may not have been used for all its bottles until after the turn of the century. (*Alexandria Gazette* April 27, 1895)

Year-round mass production, pasteurization and filtration, the availability of bottles and efficient closures all combined with the expansion of rail transport to provide a large supply of beer which could be kept for a long period of time and shipped to distant points. Such advances were responsible for the success of large breweries and the creation of regional and national markets beginning in the 1880s.

Robert Portner Brewing Company technology timeline

1865	Lager cellars are excavated on the northern half of the block bounded by Washington, Saint Asaph, Wythe and Pendleton Streets.
1866	By this time the Robert Portner Brewery acquires an eight-horsepower steam engine for mashing, running hoists and pumps, etc.
1869	Robert Portner Brewery opens on North Saint Asaph Street. The steam power is upgraded to at least twelve horsepower.
1871-1878	The brewery maintains an icehouse near the Alexandria Canal. Icehouses were built adjacent to the brewery at about the same time.
1875-1876	The brewery begins bottling its product and shipping it by rail—first to Washington, D.C.
1878	Robert Portner patents a wort cooler. He also builds and begins to sell his air-cooling machine, a substantial modification of Thomas Cook's refrigeration apparatus.
1880	Robert Portner and B.E.J. Eils patent their air-cooling machine. The brewery begins pasteurizing its bottled beer by this time. By about this time, the brewery is equipped with "ice engines" for producing ice for cold storage and shipping.
1881-1892	The brewery and its branches receive telephone service during this period.
1884	By this date, the plant is equipped with a 150-horsepower steam engine.
1886	An electric dynamo is installed in the brewery to power the first electric lights in Alexandria. The plant used a combination of electric and gas light until the mid 1890s.
1887	By this time, the brewery drills a 330-foot-deep well to tap the aquifer. Ten years later, the brewery had at least one 1000-foot well.
1891	The plant's total steam motive capacity exceeds 200 horsepower.
1894	A new fireproof brewhouse is erected. Among the innovations in the brewing process are a rice conversion tub and a Pfaudler vacuum fermentation system for recapturing carbonic acid during fermentation. The refrigeration equipment was also modernized. The bottling operation begins to employ the crown closure and bottle labels.
1901	The company erects a larger plant for the production of ice. The ice was principally used to cool insulated railroad cars for the shipment of beer. Additional ice-making capacity was subsequently added to additions at the rear of the brewery.